UNITED STATES DEPARTMENT OF AGRICULTURE

FARMERS' BULLETIN

WASHINGTON, D. C. 694 OCTOBER 19, 1915

Contribution from the Bureau of Plant Industry, Wm. A. Taylor, Chief.

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THE CULTIVATION OF PEPPERMINT AND SPEARMINT.

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INTRODUCTION.

The culture of peppermint and spearmint appears to have been introduced into this country by way of the early settled New England States. The volatile oil distilled from these plants is the principal marketable product, although there is a rather limited market for the dried herb, and it is the effort of the producers to secure the best yield of herb and oil with the highest quality consistent with economy in growing and handling the crude material.

Peppermint has always been first in importance, as the oil is widely used for medicinal and flavoring purposes. Spearmint has long been grown as a culinary herb for flavoring sauces and cooling drinks, but recently it has come into extensive use as a material for flavoring chewing gum, liqueurs, and confectionery.

For many years the United States has been the greatest producer of peppermint and spearmint oils, and from present indications bids fair to maintain the lead. Japan, Russia, Germany, and England are also considerable producers, the last two countries turning out oils of the highest commercial quality. No accurate statistics of the world's output of these commodities appear to be available, but it is the impression among those best informed that the annual production of oil exceeds 600,000 pounds, of which the United States contributes about 250,000 pounds.

Wayne County, N. Y., was the first locality in which peppermint was grown and distilled on a commercial scale. The year 1816 is

NOTE.—This bulletin is of interest to those engaged in or contemplating mint culture and is applicable to all portions of the country where mint is grown.

assigned as the date when the industry reached mature proportions, and from that time until 1889 it prospered, the area devoted to the plant at times reaching almost 4,000 acres. Gradually, however, the area decreased, until, according to present advices, there are probably not more than 300 acres being cropped with both peppermint and spearmint in Wayne and the adjoining counties.

From New York, peppermint culture extended to a few of the northern counties of Ohio, and in 1835 a plantation was made in St. Joseph County, Mich., which proved so successful that the culture soon extended to adjacent counties in southern Michigan and northern Indiana. The area has since increased, until, in 1914, it was estimated that there were 29,978 acres of peppermint under cultivation, nearly all of which was in the Michigan-Indiana district. Ohio appears to have fallen out of the race as far as commercial mint culture is concerned, leaving Michigan and Indiana as the main producing centers.

DESCRIPTION OF THE PLANTS.

Peppermint is known botanically as *Mentha piperita*. For distillation purposes two varieties are chiefly grown, the so-called black mint and the white mint. Black mint, which is the variety grown on nearly all the peppermint farms in this country, has dark purple stems and deep-green, broadly lance-shaped leaves, slightly toothed. The white mint has green stems and light-green leaves, more pointed in form and deeply toothed. The white variety yields the finest quality of oil, but the plant is less hardy and productive than the black mint and is now little cultivated in America, although in parts of Europe it is still a favorite. The domestic stocks of black mint have been from time to time replenished by importations of the finest selected strains from northern Europe, particularly from the famous mint plantations of the Mitcham district in England. When first brought over, these foreign-bred plants are usually disappointing in growth, but after thorough acclimatization they appear to be more vigorous and productive than the common long-naturalized form, known in New York as "American" or "State" mint.

The appearance of the ordinary peppermint now found growing in moist places in many localities from Massachusetts to Minnesota and south to Florida and Tennessee is too well known to warrant a lengthy description. It is a perennial plant with profuse blooms, but it rarely perfects seeds. It increases by abundant runners at or near the surface of the soil. These runners root freely and under favorable circumstances send up new growths at practically every joint or node. The stems are nearly square and grow erect, often reaching 3 feet in height. The numerous lance-shaped leaves, bright or dark green in color according to variety, are provided with many

minute oil glands, chiefly on the under surface. The small purple flowers are arranged in spikes at the ends of the branches and main stem. The whole plant exhales the well-known peppermint odor, which is greatly increased when the leaves are handled or bruised.

Spearmint (*Mentha viridis*) is a plant of even more vigorous growth than peppermint, reproducing itself by runners in the same manner as peppermint and usually tending to crowd out the latter when the two grow together. The leaves are longer and lighter green in color. The flower spikes are more pointed, and the main stem usually exceeds the branches in length. Spearmint has a distinctive odor and taste, which to most people is much less agreeable than that of peppermint. The oil glands are distributed throughout the plant in the same manner as in peppermint, but are rather less abundant.

CULTURAL REQUIREMENTS.

Peppermint and spearmint thrive best in deep soils which are rich in humus and retentive of moisture but fairly open in texture and well drained, either naturally or artificially. These conditions are more frequently combined in effectively drained swamp lands, such as are used for the special culture of cranberries, celery, lettuce, onions, and other crops for which a strong, rapid growth is desired. Peppermint and spearmint may, however, be commercially grown in well-prepared upland soils, such as will produce good corn or potatoes. For this purpose fertile loams, sandy or gravelly in character and of good texture and depth, should be selected. Light, loose, dry soils and sticky clays are alike unsuitable.

When possible, the area selected should be summer fallowed for one or two years previous to setting out the peppermint or spearmint, or it should be cropped with some plant which requires clean and frequent tillage, in order to free the land from troublesome weeds and grasses. On uplands such crops as potatoes, late sugar corn, and root crops are generally well suited for this purpose, and on reclaimed marsh lands cabbage, lettuce, or onions may be used. This cultural preparation of the soil usually proves a great economy in the subsequent care of the close-growing mint crops.

UPLAND CULTURE.

Although declining in extent, the upland culture of mint still holds favor in Wayne County, N. Y., as swampy areas in that locality suitable for the purpose are quite limited. In 1914, perhaps 100 acres of new plantings of peppermint, mostly in plats of 3 to 8 acres, were established on upland soils which had been cropped the previous year with potatoes or with vegetables for the canning factories. The plantings seen in the vicinity of Lyons, N. Y., were on "cobble loam" in good condition, which had been cropped the year before

with potatoes or with such vegetables as beets, spinach, and sugar corn. The plats were prepared early in May by rather deep plowing and thorough harrowing, special effort being made to free the soil from all remaining roots of perennial weeds and grasses. Furrows 3 inches deep and 3 feet apart were opened with a light plow, and runners dug with a potato hook from old plantings were dropped into the furrows, so as to form an almost continuous row.

When setting mint, the planter, carrying a bag on his shoulder, usually walks in the furrow, stepping on the runners as he drops them. He endeavors at the same time by a motion of the foot to cover the runners partially with loose earth, in order to keep the ends, which may be from 1 to 3 feet long, from protruding in such a manner that they might be pulled out by the tools which are used for covering and cultivating. A fair-sized wagonload of runners, weighing a ton or more, is needed to plant an acre properly. The covering is completed with a plow, a wheel hoe, or a cultivator run near the furrows.

A few days after planting it is customary to harrow the plat across the rows with a flexible-fingered weeder or rather light spike-tooth harrow and to repeat the operation at a different angle or direction as often as may be needed to keep the surface mellow and free from weeds. This is continued until the mint is high enough to be injured by the weeder or harrow, after which the tillage is confined to stirring the soil between the rows with a corn cultivator and to such hand weeding between the plants as may be necessary. By midsummer the mint usually so encroaches on the spaces between the rows that cultivation ceases, but hand hoeing and weed pulling continue until the crop is ready for cutting, which is at the time of full bloom. With new mint plantings this usually occurs early in September.

Cutting is done early in the day with a scythe or mower, according to the size of the plat and the condition of the soil. The mint is allowed to lie in the swath until half dry, and the curing is finished in windrows or cocks, as with clover hay. When fairly well dried, but before the leaves shatter on handling, it is hauled to the still.

In former years much of the mint was distilled when freshly cut, but it is now generally conceded that the small loss of oil which occurs during the curing process is well offset by the material gain in the ease with which the herb is handled, as well as the time saved in distillation. The dry herb is not only less bulky and less heavy than the freshly cut herb, but it is more quickly distilled and requires less steam for the thorough exhaustion of the oil.

In favorable seasons a very abundant second growth of mint occurs after the crop is harvested, but this aftermath is now seldom cut, as it has been found to weaken the roots greatly and to subject them to winterkilling. The usual practice is to plow down this second growth

after it has been killed by frost, turning it under about 3 inches. This apparently harsh treatment breaks up the clumps, buries the surface runners, and is thought to give a better stand than when the plants are fully exposed to the weather. The fertilizing effect of the herbage when buried is also greater than when it is permitted to decay on the surface.

The fall plowing of mint is now quite universal on all types of soil, the depth of turning under ranging from 3 inches in the heavier loams to 5 inches in loose muck. Before growth starts in the following spring, the surface of the soil is loosened with a spike-tooth harrow and cultivation is continued until the sprouts are tall enough to be injured, after which the cultivator is used in the rapidly narrowing spaces between the rows. In the second and third years, because of the thicker stands, more hand work is needed to suppress weeds and grasses. As a rule, the crops of the second and third years are ready to cut two or three weeks earlier than new plantings and should be somewhat heavier, though the oil yield is seldom materially greater. In the second season the aftermath is plowed under after frost, as in the preceding year, and similar cultivation is given the third year, after which the mint is deeply plowed under. The field is then well fertilized and seeded with winter grain or is devoted to some succession crop that will keep the land clean and in good condition. Rarely does the stand remain good enough for a fourth crop of mint.

In seasons of good oil prices, the grower may find it profitable to distill the second growth of mint in old stands that are to be abandoned, but the old fields are more often used as a source of runners and propagating roots for new plantings and in consequence are not cut over in the fall.

Upland mint culture is now practically confined to the New York district, as the abundance of suitable muck land in Michigan and Indiana precludes the necessity for using the fertile uplands in those States for the purpose. In Wayne County, N. Y., the mints are frequently grown in cooperation, one party furnishing the land and team labor and another the required tillage. After distillation a division of the oil is made.

MUCK-LAND CULTURE.

In southern Michigan and northern Indiana there are many broad, level areas, often several thousand acres in extent, of deep and fertile muck soil, the beds of ancient lakes and swamps, where the remains of ages of growths of aquatic vegetation have accumulated. These swamps and marshes have been reclaimed by drainage and plowing and by subduing the native vegetable growths until the fine black soil, with its high percentage of humus and available plant food, is especially fitted for the cultivation of a variety of useful crops.

Peppermint and spearmint find these deep, rich, and loose soils very congenial, and notable success has been obtained in the culture of these and kindred plants.

The swamps best adapted for the mints appear to be those which originally supported a growth of sphagnum moss and tamarack, the next in order of preference being the moister bur-oak lands. These soils must be thoroughly drained and the permanent water bed lowered to at least 3 or 4 feet beneath the surface, as the mints make only a weak growth in sodden ground. The tillage of these broad stretches of level and easily worked soils affords much scope for the use of large horse tools and even for traction motors in hauling the mint hay, fuel, and supplies to and from the distilling plants. In the spring the land is usually so soft from the contained moisture that the horses are provided with mud shoes, 9 or 10 inches wide, made of wood and leather and fastened to the hoofs or to the ordinary shoes by straps and metal bolts. Among the larger plantations these mud shoes are manufactured on the place.

On these muck lands planting begins in the spring as soon as the properly shod horses or oxen can be driven over the fields. The soil, cleaned by well-cultivated crops the year before, is plowed, leveled, and marked off in furrows 3 feet apart and 4 inches deep. The runners are dropped by hand, as in upland culture, but the soft footing renders the work more laborious, and it requires an expert laborer to plant an acre a day. The furrows are filled in with a drag wide enough to cover two or more rows of runners, and the weeder or light spike-tooth harrow is run over them to loosen the trampled surface. Harrowing is repeated at frequent intervals in various directions until the sprouts are too high to be further disturbed, after which corn cultivators are used between the rows until July, when the runners become so numerous as to render further tillage difficult.

Hand weeding is also used from the first appearance of the sprouts, ten days or more after planting, until the fields are thoroughly cleaned of weeds, grasses, and other plants that might lower the quality of the oil product. On large plantations it is usual to see gangs of 20 or more laborers, mostly recent immigrants, each gang under the direction of an experienced foreman, passing along the rows, hoe in hand, taking out all the interfering vegetation. Successful mint growing implies clean culture at all stages of progress.

The mint, when in bloom, is cut with mowers when the condition of the soil permits, but in rainy seasons machines do not always work well on new plantings and recourse must be had to the scythe. After sufficient drying in the swath, the mint is raked into windrows, the larger planters using continuous side-delivery horserakes for the purpose. From the windrows it is usually hauled to the stills, but

in dull weather it is at times necessary to complete the curing in cocks, although the rule is to handle the hay as little as possible, in order to avoid the loss of foliage.

The aftermath is plowed under after frost, as with upland culture, but on account of the loose nature of the soil it is covered somewhat deeper, frequently 4 to 5 inches. The second and third years of culture duplicate the first, except that cutting occurs nearly a month earlier. The harrow is started before the sprouts appear and is the main reliance as long as it can be used without materially injuring the new growth. Hand weeding begins early and is kept up until the mint has smothered out competing vegetation.

The life of a planting of mint in suitable muck soil averages about four years, after which it is found good practice to devote the area to a succession crop or to lay it down in pasture if grass can be induced to hold.

FERTILIZERS.

Notwithstanding the high nitrogen content of the swamp soils on which the mints are generally grown and their favorable texture for root penetration, there is often evidence of lack of quickly available plant food during rapid growth. Nitrate of soda, 50 to 150 pounds to the acre, well distributed and cultivated in before the tops have made too much growth, has been found profitable by progressive growers. Potash in the form of muriate or sulphate, from 150 to 300 pounds to the acre, has been widely used, with generally favorable results, to stimulate growth and darken the foliage. It appears particularly useful for a form of chlorosis apparently favored by too much water in the soil. Ground bone, acid phosphate, and lime have been tried in varying quantities by a few planters, but without marked benefit. The return of the steamed mint hay to the soil and the plowing under of the aftermath are most widely recognized as beneficial. Stable manure as a direct application is little favored, as it is often followed by watery growth and low oil content, while the resultant weeds are likely to become an intolerable nuisance. The indirect results of stable manure when applied to preceding well-cultivated crops are, however, of inestimable value.

DISEASES AND PESTS.

Aside from the chlorotic condition associated mostly with excessive moisture and probably also with too great acidity of the soil, peppermint has few serious diseases and spearmint has practically none. A rust fungus has been known to strip the foliage from the stems in particularly humid seasons, but it is usually quite local in its manifestations.

There is always the possibility of injury by crickets, grasshoppers, and caterpillars if they appear in unusual numbers. Given congenial soil and the necessary cultural attention, however, the mints do not appear to rank in certainty of production much below the usual cultivated crops of temperate climates.

YIELD, COST, AND PRICES.

Yields of 2 to 3 tons of mint herb per acre may be expected. When a market for the dried herb can be had, packers appear to prefer it chopped into 1-inch pieces and dried under cover, in order that the natural green color may be preserved as far as possible. The price received by growers for the properly cured mint herb of either species ranges from 3 to 5½ cents a pound, but the output of even a few acres would stock the market so that it would be difficult to dispose of any further quantities at paying prices.

The yield of oil is extremely variable in both peppermint and spearmint, ranging from almost nothing to nearly 100 pounds to the acre, according to the stand of the herb, its condition, and its treatment on cutting and distilling. The best yield of oil and the finest quality are to be expected the first year, after which there is a falling off each successive season until the mint is no longer worth cutting. It sometimes happens, however, that the second year proves to be the best. The largest yield is to be had only from fields which are in the best possible condition, but as a fair average for well-conducted commercial plantings, new and old, probably 30 pounds of oil per acre could be obtained, although many growers are inclined to place the average production somewhat higher. The condition of the weather at the time of cutting has an appreciable effect on the yield of oil, cool, dry weather appearing to produce less oil, even from the same field, than when the air is warm and fairly humid. About 325 pounds of peppermint and about 340 pounds of spearmint are required to produce a pound of oil in commercial practice, but as spearmint under similar cultural conditions furnishes more of the herb, the yield of oil per acre is about the same.

Few commodities have fluctuated more widely in price than has peppermint oil. Wholesale or traders' prices, as quoted in publications devoted to the drug trade, have varied from 75 cents a pound, in October, 1899, to $5 a pound, in April, 1914. The average trade price for the oil in tins, as it comes from the producer, for the 40 years from 1874 to 1914, inclusive, is in the neighborhood of $2.50 a pound, and on comparatively few occasions has it remained more than a month or two below $1 a pound.

Spearmint oil was formerly quite limited in use, and the prices ran a little lower than those for peppermint oil, but of late the price has

somewhat exceeded the latter, $5 a pound having been reached in 1909 and 1913, with a minimum of $1.50 in 1909 and again in 1914. The average trade price for the years from 1909 to 1914, inclusive, is $3.55 a pound. It must be borne in mind that the prices here given, for both peppermint and spearmint oils, are those quoted by jobbers and wholesale traders and doubtless exceed those generally received by producers. These oils, however, securely tinned, may be kept for years with little loss or deterioration and may conveniently be held out of market during periods of price depression.

Spearmint must be regarded as the less staple of the two mints, its consumption being largely restricted to the single industry of chewing-gum manufacture, and due caution should therefore be used in extending its culture.

As there is no great diversity in mint culture, the cost of preparation, tillage, and handling is perhaps more easily ascertainable than for many other crops. Careful inquiry in 1914 showed that the labor cost for establishing an acre of new mint on suitable soil in the Michigan-Indiana district and caring for it during the first season was about $30. The cost in subsequent years could be placed at $15 per acre. The estimates exclude fertilizers, taxes, interest on the land and equipment, superintendence, and other overhead charges. In Wayne County, N. Y., the cost of new plantings appeared to be less, as the land generally used needed less preparation, but the tillage costs were higher per acre, on account of the limited plantings and the greater amount of hand labor required. The price generally charged for runners sufficient to set an acre is $5, and the customary charge for distilling is 25 cents a pound for the oil secured. As with all producing operations, the large equipments are supposed to reduce the unit cost of the product.

The early stills used in this country for the extraction of mint oils appear to have been metal retorts or covered kettles connected with a long, coiled tube, usually termed the "worm." During the process of distillation this coiled tube was immersed in cold water or showered, in order to condense the products of evaporation. The water and oil came out of the worm together and were received in a vessel called the separator, which had a siphonlike tube rising from near the bottom, by means of which the water could continuously flow away, while the oil, being lighter, rose to the top and could be drawn off through another opening. The separator of to-day remains practically the same, except that it has a greater capacity. Extensive changes, however, have been made in other portions of the distilling apparatus.

In the old kettle stills, the mints, often in the green or fresh state, were immersed in water, and direct heat was applied by means of

a fire at the bottom of the kettle or boiler. The capacity of even the largest of these early stills was so limited that only a few pounds of oil could be secured from a single charge. About the year 1846 large wooden vats, supplied with steam from an ordinary engine boiler, began to be substituted for the metal kettles. These vats were provided with a perforated false bottom upon which the herb rested, and distillation was effected by passing steam upward through the material. The vats were made of sufficient capacity to contain half a ton or more of the partially dry herb at a charge and were soon arranged in pairs, fed in alternation. The steam was conveyed through long pipes from a common boiler in such a manner that one vat could be emptied and refilled while the other was being steamed. The boiler also furnished the power for hoisting the charges and for the powerful steam pump which forced the cold water through the condenser or showered it over the pipes when they were exposed. The capacity for rapid work during the urgent harvest season was thus greatly increased, and with the spread of mint culture neighborhood community stills, each of which was capable of caring for the product of many growers, soon became common. In time the capacity of the vats was increased to hold a ton or more of the partially dry herb and a few distilling plants were built with four vats fed from a common boiler and arranged about a central crane by which the heavy exhausted charges could be lifted from the vats in alternation. The average cost of the 2-vat still, with boiler, pump, and sheltering structure, appeared to have exceeded $500, and for a period of years these stills were said to have served about ten growers each.

In more recent years the large plantations of Michigan and Indiana, where the rows of mint plants under a single ownership sometimes exceed a mile in length, have necessitated far more extensive installations for expeditiously handling the vast quantities of the herb brought in from the fields. The most highly developed distilling plants to-day have four vats of approximately 3 tons capacity each, arranged about a power crane. Steam is supplied by a battery of powerful boilers operating under a pressure of 110 pounds to the square inch, which effectually vaporizes the oil in the 3-ton charge in from 10 to 15 minutes. Water for cooling the immense condenser is obtained from deep-driven wells and is forced through by powerful centrifugal pumps. The separators used by these large stills are of sufficient capacity to contain several hundred pounds of oil. The old worms have generally been replaced by modern condensers composed of a considerable number of comparatively short, straight tubes leading to a common discharge outlet, the whole being surrounded by a capacious water jacket

cooled by means of the connected pumps. The capacity of such a distillery, working continuously through the greater part of the 24 hours, is very large and is needed only for the most extensive acreages. The bulk of the mint grown in this country is distilled in equipments of the ordinary 2-ton capacity, many of which still serve the needs of several growers.

The proper drying of the herb after cutting is an important matter as regards economy of effort and the saving of time in distillation. More than three-fourths of the weight of the freshly cut tops is composed of water, the greater part of which is evaporated during exposure in the swath and windrow or in the cock when it is necessary to finish the curing in this manner. As commonly drawn from the field, the fresh weight of the herb is reduced considerably more than half, and the material not only packs better in the vats but requires only about one-third of the time needed for the distillation of the freshly cut herb, as it does not condense the steam to the same extent as fresh mint.

Laboratory experiments show an appreciable loss of oil in drying the herb, but growers are well convinced that the loss is not great enough to offset the increased cost of handling and distilling the green herb. Frost, however, occasions serious loss, as frozen mint yields scarcely half the quantity of oil which can be obtained from sound herb of the same character. Spearmint appears to lose slightly more oil by drying and freezing than peppermint.

SUMMARY.

The culture of peppermint and spearmint, mainly for their essential oils, is a well-established industry in this country, tending to become centralized in a few States where soil conditions especially favor the development of the plants, but appears capable of considerable development in other localities, should greater commercial need arise. Wayne County, N. Y., has long lost its supremacy in peppermint-oil production, on account of the competition of other specially cultivated crops, but the industry is still effectively carried on in a small way, chiefly by cooperation between landowners and practical mint growers.

In Michigan and Indiana, owing to large areas of fertile muck land susceptible of thorough drainage, mint culture has become highly specialized, a considerable part of the acreage being controlled by a few well-equipped growers who are able to handle the product in an economical manner.

Mint culture on suitable soils appears to give fair average returns when intelligently conducted from year to year. It is, however, an industry limited in scope, especially subject to fluctuations in prices

of the crop products, and likely to suffer from overproduction if the acreage is too rapidly extended. A substantial outlay is required for preparation, equipment, and cultural maintenance. The cost of properly establishing an acre of mint is placed at $30, and the annual expense for cultivation at $15 or more. Stills for extracting the oils vary greatly in cost, as they are largely constructed for local needs. It is not likely that a practical still of sufficient capacity to economically handle the product of a dozen acres of well-grown mint could be built for less than $250, but in mint-growing localities this expense is often greatly reduced by practical cooperation among producers. The customary charge for distilling mint oils for many years past has been 25 cents a pound.

According to the best obtainable estimates, the total area of mint in 1914 in Michigan, Indiana, and New York appeared to be just under 25,000 acres, of which nearly 5,000 acres were spearmint. Almost one-half of this acreage was new plantings, the remainder being in fields two or more years old.

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The Adulteration of Drugs. By Lyman F. Kebler. Pp. 251–258. 1904. (Separate 331, from Yearbook of the Department of Agriculture, 1903.) Price, 5 cents.

Peppermint. By Alice Henkel. Part 3, pp. 19–29, figs. 3. 1905. (From Bulletin 90, Bureau of Plant Industry.) Price, 5 cents.

Wild Medicinal Plants of the United States. By Alice Henkel. Pp. 76. 1906. (Bulletin 89, Bureau of Plant Industry.) Price, 5 cents.

American Root Drugs. By Alice Henkel. Pp. 80, figs. 25, pls. 7. 1907. (Bulletin 107, Bureau of Plant Industry.) Price, 15 cents.

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American Medicinal Leaves and Herbs. By Alice Henkel. Pp. 56, figs. 36. 1911. (Bulletin 219, Bureau of Plant Industry.) Price, 15 cents.

The Diseases of Ginseng and Their Control. By H. H. Whetzel and J. Rosenbaum. Pp. 44, figs. 5, pls. 12. 1912. (Bulletin 250, Bureau of Plant Industry.) Price, 15 cents.

American Medicinal Flowers, Fruits, and Seeds. By Alice Henkel. Pp. 16, figs. 12. 1913. (Bulletin 26, U. S. Department of Agriculture.) Price, 5 cents.

Wild Volatile-Oil Plants and Their Economic Importance. I.—Black Sage; II.—Wild Sage; III.—Swamp Bay. By Frank Rabak. Pp. 37, figs. 6. 1912. (Bulletin 235, Bureau of Plant Industry.) Price, 5 cents.

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1915